



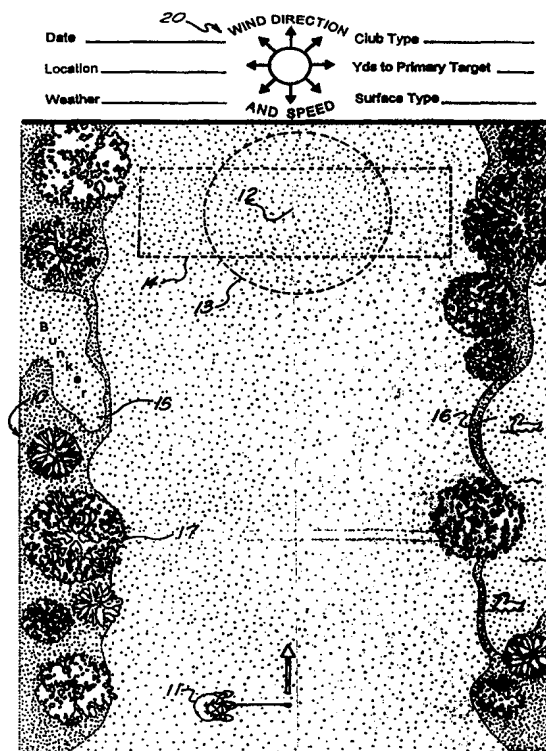
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(21) International Application Number:</b> PCT/US97/10097 <b>(22) International Filing Date:</b> 7 July 1997 (07.07.97)  <b>(71)(72) Applicant and Inventor:</b> LEWIS, Robert, D. [US/US]; 2410 Rusk Street, Beaumont, TX 77702 (US).  <b>(74) Agent:</b> REGARD, Joseph, T.; Joseph T. Regard, Ltd. plc, 299 Gitz Lane, Madisonville, LA 70447-9305 (US).		<b>(81) Designated States:</b> JP, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i>

**(54) Title:** STATISTICAL ANALYSIS AND FEEDBACK SYSTEM FOR SPORTS EMPLOYING A PROJECTILE

**(57) Abstract**

This invention is a sports practicing aid and its method of use, which includes graphic indicia in the form of a diagrammatic depiction of a typical golfing hole (10) to be used at a driving range, or other practice area which is employed by its user for recording thereon the user's shot pattern established during the course of making various actual practice shots. The aid further includes directions for its use, and a system for shot statistical tabulation configured to allow the user to summarize the user's performance in terms of shot quality, in such a manner as to allow the golfer to identify and correct errors in his golf game (swing, grip, etc.). In the preferred embodiment of the present invention, practice materials are provided in consisting of a multitude of golf hole diagrams and attendant statistical tabulations. Basic golfing tips may also be included.



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4 TITLE: Statistical Analysis and Feedback System for Sports Employing a Projectile  
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8 **FIELD OF THE INVENTION**  
9

10 The present invention relates to sports instructional systems, and in particular to a golf  
11 practicing aid and its method of use which includes graphic indicia in the form of a diagrammatic  
12 depiction of a typical golfing hole to be used at a driving range or other practice area which is  
13 employed by its user for recording thereon the user's shot pattern established during the course  
14 of making various actual practice shots.

15 The present invention further includes a system for shot statistical tabulation configured  
16 to allow the user to summarize the user's performance in terms of shot quality, in such a manner  
17 as to allow the golfer to identify and correct errors in his golf game (swing, grip, etc.).

18 In the preferred embodiment of the present invention, contemplating a markable substrate  
19 in booklet form, practice materials are provided in consisting of at least one golf hole diagram and  
20 attendant statistical tabulations. Basic golfing tips may also be included.

21 While the preferred embodiment of the invention contemplates the present system in the  
22 form of a booklet, an alternative embodiment of the present invention contemplates the utilization  
23 of a personal data assistant (PDA) having a memory, a CPU, and a screen, which PDA is  
24 programmed with a diagrammatical layout of a practice area, upon which the user may record the  
25 user's shot pattern during practice sessions.

26 The alternative embodiment of the present invention further contemplates a menu function  
27 wherein the user may consult an instructional database regarding golfing technique, historical data  
28 on past performance, transmittal functions, and programming functions including statistical  
29 manipulation of the shot data entered therein by the user for feedback, comparison, and historical  
30 use.

31 The alternative embodiment of the present invention automates the statistical analysis of

1 the user's shot pattern, providing instructional feedback, statistical data on swing patterns, and  
2 means to archive performance into memory for historical recordation and retrieval for later use  
3 and analysis, including discerning further patterns as well as improvement or decline in  
4 performance.

5 While the present invention is contemplated primarily for utilization with Golf, it is noted  
6 that the system is likewise suitable for utilization with other diverse sports employing a projectile,  
7 including, for example, tennis, billiards, horseshoes, football, baseball, hockey, soccer, rugby,  
8 cricket, basketball, and the like.

## 10 BACKGROUND OF THE INVENTION

12 The game of golf is a very popular and demanding sport. Since it is a sport that can be  
13 played individually, and can be especially practiced individually, it is popular among participants  
14 of all ages in many places throughout the world. The sport attracts many people because at first  
15 blush, it appears to be a relatively easy sport. However, upon closer inspection and actual  
16 participation, it does not take long to realize that it is a difficult sport to master, and needless to  
17 say, practice is essential in order to become even an accomplished golfer.

18 Without practice, the sport can become extremely frustrating and aggravating. For that  
19 reason, considerable books and practice aids have been introduced in the sport to aid golfers in  
20 perfecting their game. However, no product is known to exist that allows the golfer to record a  
21 series of practice shots with any given club and in any given practice area in order to identify any  
22 errors in the golfer's game.

23 Practice or study aids that require the participant to think about and evaluate some or the  
24 more important parameters that must be coordinated on each type of shot have been found to be  
25 especially useful, particularly for the less experienced golfer, because it is difficult when first  
26 learning the game, or only sparingly playing the game, to remember all of the more basic  
27 parameters that must be coordinated for any given shot. For example, a player's stance, grip, ball  
28 position, and alignment, among other things, must be coordinated for each different type of shot.

29 Among the advantages and features of the present invention is that it allows a golfer to  
30 record his shot pattern for a particular series of shots whereby with any club and at any practice  
31 area he can concentrate on one phase of the game at a time, that is, making a particular shot, and

1 concurrently record the results which he can then subsequently evaluate and analysis. That is, he  
2 need not attempt to perform all of these functions at once.

3 Among other advantages and features of the present invention is that it provides a means  
4 for rapid evaluation of the problems with the golfer's swing, stance, grip, etc. Moreover, the  
5 present aid allows Coaches or professional instructors to home in on a problem immediately. This  
6 allows an instructor/coach to be more effective in improving the students game more rapidly.  
7 Additionally, the present invention is adaptable to any practice area regarding distances,  
8 dimensions, conditions, and hazards as well as being adaptable to any golfing club.

9 The present golfing aid also allows an instructor or coach to examine the practice periods  
10 of students and their progress between practice sessions by having a written record that is a more  
11 accurate reflection of a particular student's game because it has occurred over a number of  
12 practice sessions. It can also be appreciated by one skilled in the art that the present aid is  
13 adaptable to every club and that the pad can be altered to fit a particular layout or hole design.  
14  
15

### 16 **Summary of the Invention**

17

18 The preferred embodiment of the present invention comprises a golf practicing aid booklet  
19 or pad having a multitude of diagrammatical depictions of a hole or a part thereof of a typical golf  
20 course for use at a driving range facility or other practice area on which the user marks each  
21 practice shot the user takes towards some position or target on the hole, e.g. a position down the  
22 fairway or on a green. The present booklet or pad includes directions for its use, as well as a  
23 statistical tabulation sheet.

24 The statistical tabulation sheet of the preferred embodiment of the present invention allows  
25 the user to record the number of balls hit and to differentiate between good shots versus bad  
26 shots. with the present golfing aid, the user can practice a specific type of shot, and record the  
27 results which are subsequently evaluated and analyzed by virtue of the recorded shot pattern.

28 The preferred embodiment of the invention further provides written golf instructions involving  
29 the more common golfing parameters that need be mastered in order to play the sport effectively,  
30 and in accordance with accepted form technique. The instructional information may be provided  
31 in the form of a separate, pocket sized reference pad, which would provide a summation of

1 fundamentals on appropriate golf swing techniques and ball flight analysis.

2 A useful and effective alternative embodiment of the present invention contemplates the  
3 utilization of a computerized version of the present invention implementing, as an example, a  
4 personal data assistant (PDA) having a memory, a CPU, and a screen, which PDA is programmed  
5 with a diagrammatical layout of a practice area, upon which the user may record the user's shot  
6 pattern during practice sessions. An example of an off-the-shelf PDA which might be  
7 programmable to accomplish the functions of the present invention could be, for example, the  
8 PALM PILOT as manufactured by U.S. ROBOTICS of Mountain View, California. The PALM  
9 PILOT is only a hypothetical example of an appropriate computer which may be programmable  
10 to perform the functions of the present invention. Another example might include the CASIO  
11 brand WIZARD, or any INTEL brand PENTIUM based processor Laptop or other computer or  
12 the like.

13 Computers or PDA's would be programmed such that a graphical representation of a golf  
14 hole is portrayed thereon, such that the user could input the approximate location a struck ball  
15 on the screen as it relates to a target area. Computers or PDA's having a touch sensitive screen  
16 would allow direct input of the location of the struck ball by touching the screen in the  
17 approximate location of the ball as it relates to the target while other computers, without touch  
18 sensitive screens could be inputted with the approximate location of the struck ball via mouse,  
19 pointer, or X-Y coordinates via keyboard.

20 The approximate location of the a plurality of balls would be entered into the computer  
21 or PDA, and stored in memory, while illustrating same on the screen. The computer or PDA  
22 would be programmed to analyze some or all of the inputted locations statistically to discern  
23 patterns relating to ball flight analysis, including classifying patterns as likely having been struck  
24 utilizing proper techniques, or the possible presence of anomalies in the golf swing or striking of  
25 the ball, including, for example, improper gripping procedure, improper club face alignment to  
26 the ball at striking, improper body alignment, improper aim, improper contact with the ball,  
27 improper setup, ball flight analysis, etc.

28 The computer or PDA could be programmed to provide real time analysis, so that with  
29 input of the location of the struck ball relative to the target, observations as to the location of the  
30 ball, commentaries regarding same, and instructional tips can be indicated, or, the computer can  
31 be programmed to provide a summary, statistical information, observations, and instructional hints

1 and commentary can be had after the user has completed the ball strike sequence.

2 The alternative embodiment of the present invention further contemplates a menu function  
3 wherein the user may consult an instructional database regarding golfing technique, historical data  
4 on past performance, transmittal functions (for transmitting the data to a separate computer for  
5 further use via RF, IR, cable, or modem, for example), and programming functions including  
6 statistical manipulation of the shot data entered therein by the user for feedback, comparison, and  
7 historical use.

8 The alternative embodiment of the present invention automates the statistical analysis of  
9 the user's shot pattern, providing instructional feedback, statistical data on swing patterns, and  
10 means to archive performance into memory for historical recordation and retrieval for later use  
11 and analysis, including discerning further patterns as well as improvement or decline in  
12 performance.

13 An additional feature of the present invention is that it instills in the user a step-by-step  
14 approach or methodology which trains or disciplines the user to become more thoughtful and  
15 analytical in the method of striking the ball, causing the practice session to be far more effective  
16 than the typical practice session.

17 A present objective of the invention is to provide the user a golf practicing device and  
18 apparatus which allows the user to record a multitude of different practice shots while  
19 concentrating on his swing whereby the shot pattern, established by virtue of the user's swing, can  
20 be recorded and subsequently evaluated and analyzed.

### Description of the Drawings

Figure 1 of the drawings is a diagrammatical plan view of a typical fairway or green on a typical golf course to be used at a practice area showing the position of the user taking a shot toward a particular location or target on the hole on which graphic representation the user records various practice shots with a given club.

Figure 2 of the drawings is a tabulation of the instructions for the use of the present golf practicing booklet of Figure 1.

Figure 3 of the drawings is a tabulation outline whereby the user can tabulate and calculate the percentage of good shots versus bad shots for use with the practicing booklet of Figure 1.

Figure 4 of the drawings illustrates a frontal view of an alternative embodiment to the invention of Figure 1, illustrating a computerized system for recording and disseminating user performance data, illustrating a menu of alternative programs available.

Figure 5 illustrates a frontal view of the invention of Figure 4, illustrating an exemplary diagrammatical layout of a typical fairway and green, further illustrating an approximate position of the user taking a shot at a target location, as well as exemplary markings thereon signifying struck golf ball locations relative to the target area during a golf session, as approximated by the user.

Figure 6 illustrates a frontal view of an exemplary statistical data table, illustrating statistical information which may be calculated by the computer based upon data entry by the user regarding struck ball locations relative to the target area during a session, as well as other pertinent information including instructional commentary and pertinent comment made by the computer in response to statistical information regarding shot percentages.

Figure 7 illustrates an example of a basic schematic of a CPU and Memory, comprising main hardware components of a computer or PDA as may be utilized in the alternative embodiment of the invention of Figure 4.



## Description of the Preferred Embodiment

Figure 1 of the drawings depicts the essential indicia of the preferred embodiment of the present invention, which in essence constitutes the graphic representation of a golf hole or a portion thereof, e.g., a fairway, green, cup or pin, or hazards of a typical golf course.

Reference numeral 10 of Figure 1 represents a practice area which is a reproduction of a fairway or green forming part of a golf course. The user 11 is shown in position on the fairway or in a tee box making a shot toward the marked area that is an ideal location or target 12 which can either be a position on the fairway or the pin or cup on a green. This can comprise either the circular portion 13 which represents a green with 12 being the cup or pin or the rectangular portion 14 which represents an ideal area on the fairway. The golfer determines all of this by selecting objects or areas of known distance and size at his practice area.

The latter areas 13 and 14 can also be construed as a zone within which the user 11 is attempting to consistently hit a golf ball within, such as the good in-play area on a fairway that a tee shot or other fairway shot to the pin 12. The portion 10 of a golf hole includes various other graphic indicia typifying it as a golf hole or fairway, e.g. the bunker 15 on the left, the water hazard 16 on the right, and the various trees 17.

Of course, it can be appreciated by one skilled in the art that the portion 10 of the hole arrangement shown can be illustrated in different manners, e.g. a hole having a dog-leg to the left or right, or having a bunker 15 or a water hazard 16 immediately across the path of flight of the ball hit by the user 11 toward the spot or target 12, viz. it is adaptable to different layouts.

Figure 1 further comprises the written indicia 20 above the portion 10 which allows the user to record the wind direction and speed, the date of the practice session, the practice site, the weather conditions, the type of club employed, the number of yards to the primary target 12 from the position of the user 11 shown in the portion 10, and the type of surface the practice shots were hit from or landing on.

Figure 2 of the drawings is a tabulation of directions for utilizing the present golf practice booklet or pad. The directions in paragraphs 4 and 5 thereof describe the particular function of the indicated shot areas 13 and 14. The shot area in 13 would typically comprise a green about 25 - 30 yards in diameter which would be approached primarily with an iron. Whereas, the rectangular area 14 would typically be a target 40 - 45 yards wide and 15 -20 yards deep laying

1 on a fairway which typically would be approached with a wood club.

2 Figure 3 of the drawings comprises a tabulation of the results of the user's shot pattern.  
3 For one, the user would record a total number of balls hit. In paragraph 2, the user would record  
4 the number of balls hit in a selected target area or that which the user considers to be good shots.  
5 By dividing the number of balls hit within the target area by the total number of balls hit, the user  
6 would arrive at the percentage of good shots. In paragraph 3, the various types of poor shots are  
7 recorded, specifically, in subparagraph A, the number of out of bound shots to the left; in  
8 subparagraph B, the number of out of bound shots to the right; in subparagraph C, the number  
9 of fat shots; in subparagraph D, the number of thin shots, and in subparagraph E, any other poor  
10 shots.

11 Of course, the percentage of each is derived as instructed in Figure 3. The user would then  
12 total up the number of poor shots and calculate the number of poor shots taken.

13 As pointed out above, a distinct advantage of the present Invention is that the user can  
14 record a complete pattern of practice shots taken which can then subsequently be evaluated and  
15 analyzed. In the meanwhile, the user can concentrate on the critical fundamentals that part  
16 time golfers or amateurs must do to play a decent round of golf. Of course, someone who plays  
17 considerable golf, especially a professional, executes a lot of these fundamentals automatically  
18 without thinking about it.

19 On the other hand, an amateur must constantly review in his mind these fundamentals. The  
20 present invention allows the user to record various golf shots without trying to subsequently recall  
21 them from his memory and then analyze what he may have been doing wrong in making that  
22 particular shot.

23 The user can either take a multitude of practice shots employing what the user thinks is  
24 the manner of executing the critical fundamentals and thereafter subsequently review the recorded  
25 pattern of golf shots to determine what particular fundamental was not being employed or  
26 followed. Another distinct advantage of the present invention, is that it not only allows the user  
27 to record his pattern of practice shots and personally evaluate his performance at a later time, but  
28 additionally, gives him a recorded history of such shots which he can subsequently discuss with  
29 others, e.g. an instructor who would be able to shed some light on the user's problems.

30 Yet another advantage of the present invention is that every visual aid an amateur golfer  
31 can add to the perfection of his game generally makes it easier for the golfer to subsequently

1 analyze and improve his game. Merely trying to go back and remember what you might have done  
2 wrong on a particular shot is extremely difficult, and in any event, makes its impossible to  
3 subsequently confer with an expert to ascertain exactly what you did do wrong on a particular  
4 shot. Thus, it becomes apparent that the present golfing aid is primarily designed for making a  
5 series of practice shots.

6 It would be apparent to one skilled in the art that many changes can be made to the basic  
7 inventive concept disclosed herein without departing from the true scope and spirit of the present  
8 invention. For example, the position of various hazards shown in Figure 1 of the drawings can be  
9 varied as well as the target areas. Additionally, the location of the written indicia portion 20 can  
10 be relocated.

11 Moreover, the instructions of Figure 2 of the drawings can be varied. Additionally the  
12 statistical tabulation shown in Figure 3 of the drawings can be varied without departing from the  
13 true scope and spirit of the present invention. Last but not least, as pointed out above, the present  
14 golf practice booklet or pad preferably includes, either as a single tablet or in the form of a  
15 separate, pocket sized booklet, a series of illustrated critical golf fundamentals as well as primary  
16 ball flights that occur depending upon variations in following such critical golf fundamentals. A  
17 set of causes accompanies each ball flight to explain to the user what fundamental may have been  
18 violated assuming said ball flight pattern was not desired to start with. A given ball flight that is  
19 not desired would depend upon violation of one or more critical fundamentals, such as grip, ball  
20 position, open stance, and so forth.

21 The preferred embodiment of the present invention comprises a pad of the present  
22 diagrammatical golf course hole arranged in a conventional stenographic size 6 x 10 inch wire  
23 bound booklet comprising a multitude of Figure 1 diagrams with the Figure 3 statistical tabulation  
24 printed on the back thereof. The pad E would also preferably include the Figure 2 instructions and  
25 a sample Figure 1 shot pattern embodied on the first few pages followed by critical fundamental  
26 illustrations, such as grip, stance, and so forth and typical ball flight patterns following such  
27 fundamentals which precede a multitude of Figure 1 printed and graphic indicia materials.

28 Referring now to Figures 4-7, the teachings of the present invention are not limited to  
29 tablet form, and may be employed electronically, providing an automated means of storing and  
30 calculating statistics, as well as providing access to database information in golfing techniques  
31 pertinent to improving performance, based upon analysis the user's golf shots.

1 A useful and effective alternative embodiment of the present invention contemplates the  
2 utilization of a computerized version of the present invention implementing, as an example, a  
3 personal data assistant (PDA) having a memory, a CPU, and a screen, which PDA is programmed  
4 with a diagrammatical layout of a practice area, upon which the user may record the user's shot  
5 pattern during practice sessions. An example of an off-the-shelf PDA which might be  
6 programmable to accomplish the functions of the present invention could be, for example, the  
7 PALM PILOT as manufactured by U.S. ROBOTICS of Mountain view, California. As earlier  
8 discussed, the PALM PILOT is only a hypothetical example of an appropriate computer which  
9 may be programmable to perform the functions of the present invention. Another example might  
10 include the CASIO brand WIZARD, or any INTEL brand PENTIUM based processor Laptop  
11 or other computer or the like, as well as a custom computer manufactured for the purpose of the  
12 present invention.

13 As shown, the alternative embodiment of the present invention is in the form of a  
14 computer having data entry means in the form of a touch sensitive screen, mouse, keyboard, or  
15 the like, a CPU 110 (which communicates with a display or screen 100 via display interface 112  
16 or the like), and memory 111. The present system may comprise, for example, a portable  
17 computer or personal digital assistant or PDA, such as the unit shown in Figure 4. As shown the  
18 PDA 101 includes a screen 100 which preferably is touch sensitive, wherein data entry may be  
19 accomplished by stylus 102. The PDA has stored in memory a program for ball flight analysis,  
20 such that the user may initiate same by powering on the unit via power button 103, logging on  
21 the unit, thereby identifying the user to the system and initiating said program from a list of  
22 programs on the unit.

23 The present invention contemplates a menu function wherein the user may consult an  
24 instructional database regarding golfing technique, historical data on past performance, transmittal  
25 functions (for transmitting the data to a separate computer for further use via RF, IR, cable, or  
26 modem, for example), and programming functions including statistical manipulation of the shot  
27 data entered therein by the user for feedback, comparison, and historical use.

28 An exemplary menu for a ball flight program, which may be amongst those programs on  
29 the unit, is indicated on the screen 100 of the unit in Figure 4, entitled, for example, "Ballmark  
30 Practice Program", including as choices "Instruction" 104, which may include selected golf  
31 techniques for improving form or performance, and may be tailored by the unit to enhance

1 perceived weaknesses in the users performance, which user the unit has become aware due to the  
2 user's logging on to the unit.

3 Another category which may be included is "Historical Data" 105, which may include, for  
4 example information stored on past performance of the user, including completed practice  
5 sessions, statistical data and summaries.

6 A third category which preferably would be found is the "Practice Program", which would  
7 allow the user to practice golf strokes and enter the results directly into the unit for recordation,  
8 analysis, and feedback. In initiating such a program, the user would generally be questioned as  
9 to certain environmental factors regarding the practice area, including, for example, wind  
10 direction and speed, the date of the practice session, the practice site, the weather conditions, the  
11 type of club employed, the number of yards to the primary target from the position of the user,  
12 and the type of surface the practice shots were hit from or landing on. Other factors may include,  
13 for example, the slope of the practice surface, the presence of precipitation, the type of ball  
14 utilized, whether this was a day or night session, the time, etc. It is noted that the sequence for  
15 entering the environmental criteria is a programming choice, and said criteria may be entered  
16 before the practice session, and said criteria may be a part of the practice screen having the

17 Referring to Figure 5, the unit is employed during a practice session in much the same way  
18 as the preferred, booklet form of the invention of Figures 1-3, with the display screen forming the  
19 markable substrate via stylus or the like, or other alternative forms of data input as earlier  
20 mentioned. As shown, the practice program segment of the present invention includes the on-  
21 screen depiction of a approximated graphical representation of a golf hole or a portion thereof,  
22 e.g., a fairway, green, cup or pin, or hazards of a typical golf course, which approximation can  
23 be that of the actual practice area, or an imaginary hole layout employed and visualized during the  
24 user during the practice session.

25 As indicated in Figure 5, the exemplary practice area 110' may be in the form of an  
26 imaginary or actual, approximated reproduction of a fairway or green forming part of a golf  
27 course. The user 211 is symbolically shown in position on the fairway or in a tee box aligned to  
28 make a shot toward the marked area that is an ideal location or target 212 which can either be a  
29 position on the fairway or the pin or cup on a green. This can comprise either the circular portion  
30 213 which represents a green with 212 being the cup or pin or the rectangular portion 214 which  
31 represents an ideal area on the fairway. The golfer determines all of this by selecting objects or

1 areas of known distance and size at his practice area. The latter areas 213 and 214 can also be  
2 construed as a zone within which the user 211 is attempting to consistently hit a golf ball within,  
3 such as the good in-play area on a fairway that a tee shot or other fairway shot to the pin 212. The  
4 portion 110' of a golf hole may include various other graphic indicia typifying it as a golf hole or  
5 fairway, e.g. the bunker on the left, for example, a water hazard, and/or various trees.

6 Of course, it can be appreciated by one skilled in the art that the portion 110' of the hole  
7 arrangement shown can be illustrated in different manners, e.g. a hole having a dog-leg to the left  
8 or right, or having a bunker or a water hazard immediately across the path of flight of the ball hit  
9 by the user toward the spot or target, viz. it is adaptable to different layouts.

10 Also, the hole arrangement can easily be rendered to approximate golf course layouts,  
11 wherein the user may actually be present on said course and utilize the present system to record  
12 shots for real time statistical information and instructional feedback, or may utilize said actual  
13 courses in visualizing a virtual golf session in a practice area, field, or other golf course.

14 Further, the present system may be utilized not only for practicing tee-offs and fairway  
15 shots, but may also be utilized for practicing chips and putting on the green in the same manner  
16 as taught herein.

17 In use, as indicated, the unit of the alternative embodiment of the present invention would  
18 be programmed such that a graphical representation of a golf hole is portrayed thereon, such that  
19 the user could input the approximate location a struck ball on the screen as it relates to a target  
20 area. The preferred, alternative embodiment of the present invention includes a touch sensitive  
21 screen which would, via stylus, pen, user's finger, or other instrument would allow direct input  
22 of the location of the struck ball by touching the screen in the approximate location of the ball as  
23 it relates to the target while other computers, without touch sensitive screens could be inputted  
24 with the approximate location of the struck ball via mouse, pointer, or X-Y coordinates via  
25 keyboard.

26 The approximate location of the a plurality of balls would be entered into the unit, and  
27 stored in memory, while illustrating same on the screen.

28 Referring to Figure 6, the unit could be programmed to analyze some or all of the inputted  
29 locations statistically to discern patterns relating to ball flight analysis, including classifying  
30 patterns as likely having been struck utilizing proper techniques, or the possible presence of  
31 anomalies in the golf swing or striking of the ball, including, for example, improper gripping

1 procedure, improper club face alignment to the ball at striking, improper body alignment,  
2 improper aim, improper contact with the ball, improper setup, ball flight analysis, etc.

3 As shown a tabulation of the results of the user's shot pattern is calculated and displayed  
4 based upon the user's environmental data input and input regarding the end location of the struck  
5 golf balls, as depicted in Figure 5.

6 As an example, first indicated is the total number of balls hit, next the number or balls hit  
7 in a selected target area or that which is within acceptable location parameters to be classified as  
8 a "good shot". By dividing the number of balls hit within the target area by the total number of  
9 balls hit, the program would arrive at the percentage of good shots.

10 Next, various classifications of poor shots are indicated, specifically, including, for  
11 example, the number of out of bound shots to the left; the number of out of bound shots to the  
12 right; the number of fat shots; the number of thin shots, and any other poor shots.

13 The computer or PDA could be programmed to provide real time analysis, so that with  
14 input of the location of the struck ball relative to the target, observations as to the location of the  
15 ball, commentaries regarding same, and instructional tips can be indicated, or, the computer can  
16 be programmed to provide a summary, statistical information, observations, and instructional hints  
17 and commentary can be had after the user has completed the ball strike sequence.

18 Lastly, based upon patterns in the statistical data, such as, for example, a high percentage  
19 of "Out of bounds right", the computer may refer to an golf instructional database to discern  
20 possible causes for such ball flights, and display commentary on same with instruction and hints.

21 Thereby, the present invention automates the statistical analysis of the user's shot pattern,  
22 providing instructional feedback, statistical data on swing patterns, and means to archive  
23 performance into memory for historical recordation and retrieval for later use and analysis,  
24 including discerning further patterns as well as improvement or decline in performance.

25 Thusly, the alternative embodiment of the present invention provides the user with a golf  
26 practicing device and apparatus which allows the user to record a multitude of different practice  
27 shots while concentrating on his swing whereby the shot pattern, established by virtue of the user's  
28 swing, can be recorded and subsequently evaluated and analyzed.

29 Thus, in summary, the alternative embodiment of the present invention comprises a  
30 markable substrate or screen depicting a diagrammatical layout of a golf hole including hazards  
31 graphically depicted thereon, on which substrate a user can mark practice golf shots with

1 reference to a target area graphically depicted thereon, providing golf shot indicia 215,

2 The present invention further comprises a statistical tabulation means for analyzing said  
3 golf shot indicia, discerning the location of at least some of said golf shots and discerning the  
4 number of golf shots within said target area and the number of golf shots outside of said target  
5 area, as well as the relative location of said golf shots relative to said target area, said statistical  
6 tabulation means in the form of a microprocessor or CPU driven program, and further including  
7 analyzation means for discerning patterns relative to the location of said golf shots relative to said  
8 target area, providing the categorizing at least some of said golf shots based upon the relative  
9 location of said golf shots, in order to discern particular areas of weakness in said users golf  
10 swing.

11 As indicated, the "markable substrate" could comprise a display, which may be touch  
12 sensitive.

13 The memory of the present system provides a data storage means, said data storage means  
14 having stored thereon golf instructional data, although a hard drive or other data storage system  
15 may also be implemented.

16 The present system may further include in the program a golf instructional database, as  
17 well as analyzation of the statistical information do discern in the users golf swing, said feedback  
18 means including communicating to said user selected golf instructional data to improve said  
19 discerned weakness in said users golf swing.

20 An exemplary method of aiding a user in developing a golf swing, utilizing the present  
21 system might comprise the steps of, for example:

22 a. providing a computer having a visual display depicting a diagrammatical layout of a golf  
23 hole including hazards graphically depicted thereon, on which a user can mark practice golf shots  
24 with reference to a target area graphically depicted thereon;

25 b. practicing striking golf balls at a target, comprising the further steps of:

26 i. striking a first golf ball at a target area having a target point;

27 ii. discerning the end location of said struck first golf ball relative to said target point;

28 iii. visualizing said target point as said golf hole on said visual display of said computer,  
29 inputting into said computer the approximate location of said first golf ball relative to said target  
30 point, as depicted on said visual display;

31 iv. striking another golf ball at a target area having a target point;



- 1 v. discerning the end location of said other struck golf ball relative to said target point;  
2 vi. visualizing said target point as said golf hole on said visual display of said computer,  
3 inputting into said computer the approximate location of said other golf ball relative to said target  
4 point, as depicted on said visual display;  
5 vii. repeating steps iv-vi until the desired amount practice has been achieved, generating  
6 golf ball location data of each ball relative to said target point,, forming a database of ball location  
7 data entries for a practice session;  
8 c. statistically analyzing said database to discern patterns in said golf ball location data.

9 As indicated supra, the method of the present invention may provide the additional step  
10 of providing a database of golf instructional information including ball flight analysis, said  
11 database indexed according to the lie of a ball after a shot, and wherein there is further included  
12 after step "c" the additional step of utilizing said patterns in said golf location data to access  
13 instructional information on said database of golf instructional information, thereby improving  
14 upon said user's golf swing. It is further reiterated that the present system may be utilized for  
15 recording golf tee-offs, swings on a fairway, chips, putts, or virtually any club or type of swing,  
16 as well as approximating a variety of environmental target and location layouts.

17 While the present invention is contemplated primarily for utilization with Golf, it is noted  
18 that the system is likewise suitable for utilization with other diverse sports employing a projectile,  
19 including, for example, tennis, billiards, horseshoes, football, baseball, hockey, soccer, rugby,  
20 cricket, basketball, riflery and the like. In the case of golf, the projectile, a golf ball, is "launched"  
21 via striking same with a club face. With billiards, the billiards ball the projectile, which is struck  
22 with a cue, with horseshoes, the projectile is a horseshoe launched with the hand towards the  
23 target area, i.e., a rod protruding from the ground; in hockey, the projectile is a puck, which is  
24 launched via hockey stick; in basketball, the ball is the projectile which is launched via the hands  
25 of the user; in soccer, the ball is launched with the feet, in cricket and baseball, the ball is launched  
26 with the bat, in riflery, the projectile is a bullet launched with a gun at a target which may be a  
27 paper bulls-eye.

28 In each of the above examples, one can benefit from practice sessions whereby strikes the  
29 projectile towards the target area, observes where it lands, and recording same; also, in each of  
30 the above catagories, the compiled data on the locations of the projectiles can be analyzed for  
31 patterns, a database consulted to discern likely causes of said patterns, and instructional

1 information or hints displayed by the unit to the user for correcting improper form.  
2

3 In light of the above, it can be appreciated by one skilled in the art that many varying  
4 different embodiments can be made within the scope of the present inventive concept, and  
5 accordingly, it is be understood that the details of the present concept are to be 5 interpreted as  
6 illustrative and not in a limiting sense. Therefore, what is intended to be encompassed within the  
7 ambit of the present invention is that as set forth and particularly pointed out in the appended  
8 claims.  
9

1 What is CLAIMED is:

2  
3 1. Golf practicing aid means for aiding a user in developing a golf swing, comprising:  
4 a markable substrate depicting a diagrammatical layout of a golf hole graphically depicted  
5 thereon, on which substrate a user can mark practice golf shots with reference to a target area  
6 graphically depicted thereon,

7 said golf practicing aid means further comprising a statistical tabulation markable substrate  
8 on which the user inscribes the number of good shots within a target area and the number of poor  
9 shots, whereby the user can then calculate the percentage of good shots versus poor shots,

10 said statistical tabulation markable substrate further comprising poor shot indicia, setting  
11 forth categories a breakdown of poor shots, said poor shot indicia arranged to enable a user to  
12 indicate on said statistical tabulation markable substrate the number of poor shots in each of said  
13 categories, and thereby discern particular areas of weakness in said users golf swing.

14  
15 2. The golf practicing aid means of claim 1 further characterized in that a multitude of  
16 markable substrates are combined in the form of booklet means.

17  
18 3. The golf practicing aid means of claim 2 further characterized in that said booklet means  
19 includes illustrated critical fundamental golfing instructions.

20 4. The golf practicing aid means of claim 3 further characterized in that said booklet  
21 means includes illustrated ball flight analyses.

22  
23 5. The golf practicing aid means of claim 1 further characterized in that said markable  
24 substrate is further defined as depicting a target area comprising a rectangular area having a  
25 specific target point therein and a circular area superimposed thereon representing a green  
26 whereby the specific target point represents a pin so that the user can record either practice  
27 fairway shots or green shots.

28  
29 6. The golf practicing aid means of claim 1 further characterized in that said markable  
30 substrate is further defined as having a portion thereon for recording pertinent information such  
31 as the date, location, weather, wind direction, club type, yards to primary target, and surface type.

1  
2 7. The method of aiding a user in developing a golf swing, comprising the steps of:

3 a. providing in booklet form, a markable substrate depicting a diagrammatical layout of a golf  
4 hole including hazards graphically depicted thereon, on which substrate a user can mark practice  
5 golf shots with reference to a target area graphically depicted thereon said golf practicing aid  
6 means further comprising a statistical tabulation markable substrate on which the user inscribes  
7 the number of good shots within a target area and the number of poor shots, whereby the user can  
8 then calculate the percentage of good shots versus poor shots, said statistical tabulation markable  
9 substrate further comprising poor shot indicia, setting forth a breakdown of at least two categories  
10 of poor shots, said poor shot indicia arranged to enable a user to indicate on said statistical  
11 tabulation markable substrate the number of poor shots in each of said categories, and thereby  
12 discern particular areas of weakness in said users golf swing:

13 b. practicing striking golf balls at a target, comprising the further steps of:

14 i. striking a first golf ball at a target area having a target point;  
15 ii. discerning the end location of said struck first golf ball relative to said target point;  
16 iii.. visualizing said target point as said golf hole on said diagrammatical layout of said  
17 markable substrate, marking on said markable substrate the approximate location of said first golf  
18 ball relative to said target point;

19 iv. striking another golf ball at a target area having a target point;  
20 v. discerning the end location of said other struck golf ball relative to said target point;  
21 vi. visualizing said target point as said golf hole on said diagrammatical layout of said  
22 markable substrate, marking on said markable substrate the approximate location of said other  
23 golf ball relative to said target point;

24 vii. repeating steps iv-vi until the desired amount practice has been achieved, generating  
25 various marks on said diagrammatical layout of said markable substrate;

26 c reviewing the various marks generated during step i-iv on said markable substrate,  
27 determining the positions of said various marks relative to said golf hole and the locations of said  
28 various marks relative to said target area of said diagrammatical layout;

29 d. inscribing on said statistical tabulation markable substrate the number of shots within  
30 a target area, and the number of shots outside of the target area;

31 e. calculating the percentage of good shots versus poor shots;

1 f. discerning the locations of said poor shots relative to the target area, determining a poor  
2 shot pattern;

3 g. utilizing said poor shot pattern to adjust said user's golf swing, thereby improving upon  
4 said user's golf swing.  
5

6 8. The method of claim 7, wherein there is further provided in step "f" the additional step  
7 of breaking down said poor shot pattern into locational categories, and indicating on said  
8 statistical tabulation markable substrate the number of poor shots in each of said categories.  
9

10 9. The method of claim 7, wherein in step "f" there is provided the additional step of  
11 providing critical fundamental golfing instructions associated with said markable substrate, and  
12 there is further provided in step "g" the additional step of referring to said critical fundamental  
13 golfing instructions in conjunction with said poor shot pattern, in order to diagnose a weakness  
14 in said user's golf swing, and thereby adjust said user's golf swing.  
15

16  
17 10. Golf practicing aid means for aiding a user in developing a golf swing, comprising:  
18 a markable substrate depicting a diagrammatical layout of a golf hole graphically depicted  
19 thereon, on which substrate a user can mark practice golf shots with reference to a target area  
20 graphically depicted thereon, providing golf shot indicia,

21 said golf practicing aid means further comprising a statistical tabulation means for  
22 analyzing said golf shot indicia, discerning the location of at least some of said golf shots and  
23 discerning the number of golf shots within said target area and the number of golf shots outside  
24 of said target area, as well as the relative location of said golf shots relative to said target area,

25 said statistical tabulation means further including analyzation means for discerning patterns  
26 relative to the location of said golf shots relative to said target area, providing the categorizing  
27 at least some of said golf shots based upon the relative location of said golf shots, in order to  
28 discern particular areas of weakness in said users golf swing.  
29

30 11. The golf practicing aid means of Claim 10 further characterized in that said markable  
31 substrate comprises a computer display.

1           12. The golf practicing aid means of Claim 11 further characterized in that said computer  
2 display is a component of a computer, and said computer display is in the form of a touch  
3 sensitive screen.

4           13. The golf practicing aid means of claim 12 further characterized in that said statistical  
5 tabulation means is accomplished via a microprocessor driven program.

6           14. The golf practicing aid means of claim 13 further characterized in that said computer  
7 includes data storage means, said data storage means having stored thereon golf instructional  
8 data, and said analyzation means further comprises feedback means for discerning appropriate golf  
9 instructional data to improve said discerned weakness in said users golf swing, said feedback  
10 means including communicating to said user selected golf instructional data to improve said  
11 discerned weakness in said users golf swing.

12           15. The golf practicing aid means of claim 10 further characterized in that said markable  
13 substrate is further defined as depicting a target area comprising a rectangular area having a  
14 specific target point therein and a circular area superimposed thereon representing a green  
15 whereby the specific target point represents a pin so that the user can record either practice  
16 fairway shots or green shots.

17  
18           16. The golf practicing aid means of claim 14 further characterized in that said statistical  
19 tabulation means further includes input means for inputting pertinent information such as the date,  
20 location, weather, wind direction, club type, yards to primary target, and surface type by said user,  
21 said statistical tabulation means considering said pertinent information in analyzing said golf shot  
22 indicia.

23  
24           17. The method of aiding a user in developing a golf swing, comprising the steps of:  
25           a. providing a computer having a visual display depicting a diagrammatical layout of a golf  
26 hole graphically depicted thereon, on which a user can mark practice golf shots with reference  
27 to a target area graphically depicted thereon;  
28           b. practicing striking golf balls at a target, comprising the further steps of:  
29           i. striking a first golf ball at a target area having a target point;  
30           ii. discerning the end location of said struck first golf ball relative to said target point;  
31           iii. visualizing said target point as said golf hole on said visual display of said computer,

1 inputting into said computer the approximate location of said first golf ball relative to said target  
2 point, as depicted on said visual display;

3 iv. striking another golf ball at a target area having a target point;

4 v. discerning the end location of said other struck golf ball relative to said target point;

5 vi. visualizing said target point as said golf hole on said visual display of said computer,  
6 inputting into said computer the approximate location of said other golf ball relative to said target  
7 point, as depicted on said visual display;

8 vii. repeating steps iv-vi until the desired amount practice has been achieved, generating  
9 golf ball location data of each ball relative to said target point,, forming a database of ball location  
10 data entries for a practice session;

11 c. statistically analyzing said database to discern patterns in said golf ball location data.  
12

13 18. The method of Claim 17, wherein there is included after step "c" the additional step  
14 of providing a database of golf instructional information including ball flight analysis, said  
15 database indexed according to the lie of a ball after a shot, and wherein there is further included  
16 after step "c" the additional step of utilizing said patterns in said golf location data to access  
17 instructional information on said database of golf instructional information, thereby improving  
18 upon said user's golf swing.

19 19. Sports practicing aid means for aiding a user in developing a technique for  
20 launching a projectile, comprising:

21 a markable substrate depicting a diagrammatical layout of a practice area graphically  
22 depicted thereon, on which substrate a user can mark practice projectile shots with reference to  
23 a target area graphically depicted thereon, providing projectile shot indicia,

24 said sports practicing aid means further comprising a statistical tabulation means for  
25 analyzing said sports shot indicia, discerning the location of at least some of said projectile shots  
26 and discerning the number of projectile shots within said target area and the number of projectile  
27 shots outside of said target area, as well as the relative location of said projectile shots relative  
28 to said target area,

29 said statistical tabulation means further including analyzation means for discerning patterns  
30 relative to the location of said projectile shots relative to said target area, providing the  
31 categorizing at least some of said golf shots based upon the relative location of said golf shots,

1 in order to discern particular areas of weakness in said users projectile launching technique.  
2  
3

4 20. The method of aiding a user in launching a projectile, comprising the steps of:

5 a. providing a computer having a visual display depicting a diagrammatical layout of a practice  
6 area graphically depicted thereon, on which a user can mark practice projectile shot locations  
7 with reference to a target area graphically depicted thereon;

8 b. practicing striking projectiles at a target, comprising the further steps of:

9 i. launching a first projectile at a target area having a target point;

10 ii. discerning the end location of said struck first projectile relative to said target point;

11 iii. visualizing said target point as said target area on said visual display of said computer,  
12 inputting into said computer the approximate location of said end location first projectile relative  
13 to said target point, as depicted on said visual display;

14 iv. launching another projectile at a target area having a target point;

15 v. discerning the end location of said other launched projectile relative to said target point;

16 vi. visualizing said target point as said other launched projectile on said visual display of  
17 said computer, inputting into said computer the approximate location of said other launched  
18 projectile relative to said target point, as depicted on said visual display;

19 vii. repeating steps iv-vi until the desired amount practice has been achieved, generating  
20 projectile location data of each projectile relative to said target point,, forming a database of  
21 projectile location data entries for a practice session;

22 c. statistically analyzing said database to discern patterns in said projectile location data.  
23  
24

25 21. The method of Claim 20, wherein there is included after step "c" the additional step  
26 of providing a database of instructional information including projectile flight analysis, said  
27 database indexed according to the lie of a projectile after a launch, and wherein there is further  
28 included after step "c" the additional step of utilizing said patterns in said projectile location data  
29 to access and select for display certain instructional information on said database of instructional  
30 information, thereby improving upon said user's projectile launching technique.  
31



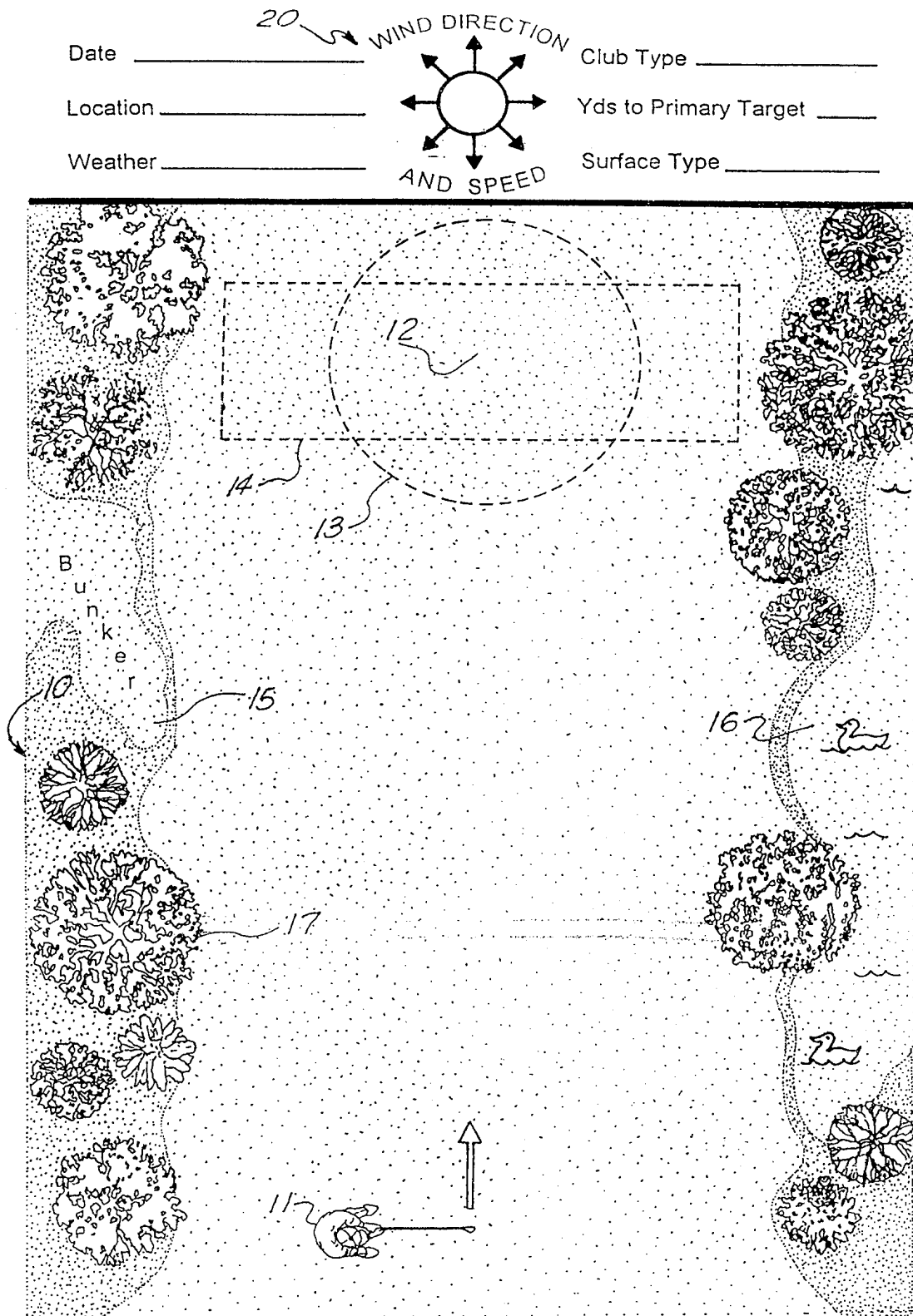


FIG. 1

*THE PURPOSE OF THE BALLMARK<sup>®</sup> PAD IS TO ASSIST THE GOLFER IN HITTING THE BALL STRAIGHTER AND MORE ACCURATELY BY CHARTING EACH PRACTICE SHOT AND BASED UPON BALL LOCATION, TO SPOT PROBLEM AREAS AND MAKE CORRECTIONS. THE PAD WILL ALSO SLOW YOUR PRACTICE A LITTLE, TENDING TO INCREASE YOUR FOCUS ON EACH SHOT AND LEAD TO A MORE PRODUCTIVE SESSION.*

#### DIRECTIONS

1. FILL OUT ALL INFO AT TOP OF PRACTICE SHEET- DATE, WEATHER, WIND, CLUB, ETC.
2. THE WATER HAZARD, BUNKER, TREES AND SHADED AREAS ON THE LEFT AND RIGHT SIDE OF THE FAIRWAY/GREEN ARE OUT OF BOUNDS. CONCENTRATE ON STAYING OUT OF THESE AREAS (STILL—BE SURE TO MARK YOUR SHOTS THAT GO THERE).
3. AT YOUR DRIVING RANGE OR PRACTICE AREA, SELECT TARGET OR AREA OF KNOWN DISTANCE AND HAVE THAT CORRESPOND TO THE PRIMARY TARGET (⊗) ON THE PRACTICE SHEET. THE PRIMARY TARGET IS CENTERED WITHIN THE SECONDARY TARGETS (⊖) AND CAN BE ANY DISTANCE RELATIVE TO YOUR CLUB, YOUR POWER AND TYPE OF SHOT YOU ARE MAKING (I.E. 250± YARDS WITH A DRIVER).
4. THE RECTANGULAR SECONDARY TARGET SURROUNDING THE PRIMARY TARGET CAN BE USED FOR LONGER FAIRWAY OR TEE SHOTS. IT CAN BE ANY DIMENSION YOU DESIRE—SAY 40-45 YARDS WIDE AND 15-20 YARDS DEEP MIGHT BE GOOD WITH A FAIRWAY WIDTH OF 45-50 YARDS. A GOOD LONG TEE SHOT WOULD GO INTO THIS AREA, WITH GREAT SHOTS GOING ON THE HIGH SIDE OR BEYOND AND GOOD SHOTS MARKED ON THE LOW SIDE OR JUST BELOW.
5. THE CIRCULAR SECONDARY TARGET AREA, ALSO SURROUNDING THE PRIMARY TARGET, CAN BE A GREEN ABOUT 25-30 YARDS IN DIAMETER. YOU CAN HIT TO THIS AREA WITH ANY CLUB, BUT IT MIGHT BE PARTICULARLY GOOD FOR MOST IRONS, CHIP SHOTS, ETC. IF YOU DESIRE, MARK YOUR OWN CUP, CHANGE THE SHAPE OF THE GREEN OR ADD A BUNKER OR OTHER HAZARD TO FIT YOUR CONDITIONS.
6. THE NEXT PAGE IS A SAMPLE SHEET SHOWING 100 BALLS HIT TO A GREEN WITH A 5 IRON WITH A PRIMARY TARGET 160 YARDS DISTANT. REMEMBER TO SET THIS DISTANCE ACCORDING TO YOUR PERSONAL REQUIREMENTS.
7. THE REVERSE OF EACH SHEET HAS THE STATISTICAL BREAK-DOWN OF YOUR PRACTICE SESSION. IT'S ALSO USEFUL IF YOU WANT TO KEEP UP WITH PERCENTAGES.

GOOD LUCK!

8. THE PAGES FOLLOWING THE SAMPLE SHEET INCLUDE A VERY GOOD LESSON THAT REVIEWS CRITICAL FUNDAMENTALS AND HAS THE NINE PRIMARY BALL FLIGHTS WITH APPROPRIATE CAUSE FOR THAT PARTICULAR FLIGHT. STUDY THIS – IT IS VERY USEFUL IN UNDERSTANDING AND CORRECTING ERRORS IN YOUR SHOT.

REMEMBER – THIS IS A GOOD GENERAL GUIDE FOR PRACTICE – FEEL FREE TO MAKE ANY ALTERATIONS TO FIT YOUR NEEDS.

FIGURE 2

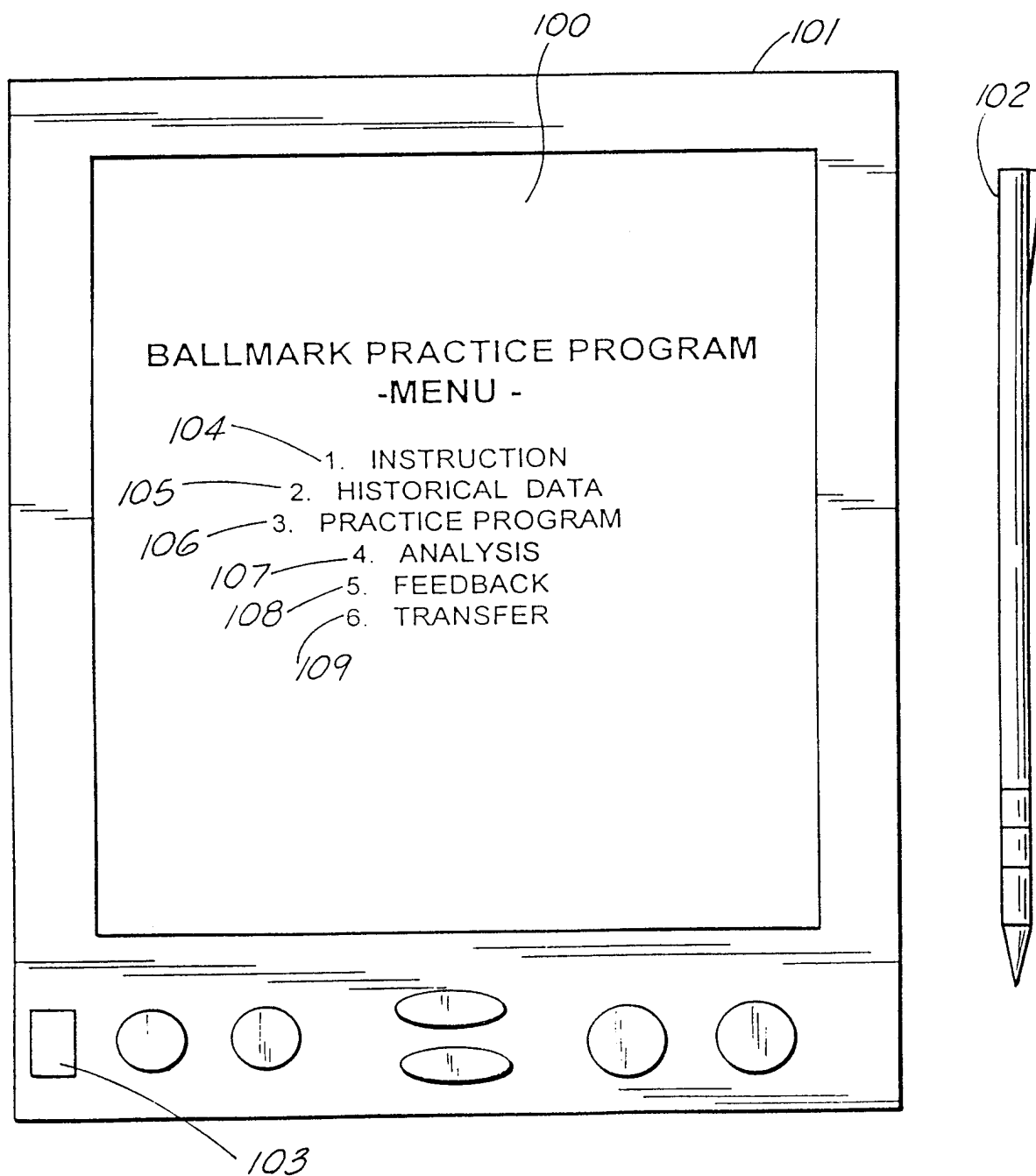
## FIGURE 3

### YOUR STATS...

1. TOTAL NUMBER OF BALLS HIT.....
2. NUMBER OF BALLS IN TARGET AREA  
OR THAT YOU CONSIDER GOOD .....  
*PERCENTAGE OF GOOD SHOTS*  
*(NO. 2 ÷ NO. 1) .....*
3. NUMBER OF POOR SHOTS:
  - A. OUT OF BOUNDS LEFT.....  
*PERCENTAGE LEFT (NO. 5A ÷ NO. 1) ...*
  - B. OUT OF BOUNDS RIGHT.....  
*PERCENTAGE RIGHT (NO. 5B ÷ NO. 1) .....*
  - C. FAT SHOTS .....  
*PERCENTAGE FAT (NO. 5C ÷ NO. 1) ....*
  - D. THIN SHOTS .....  
*PERCENTAGE THIN (NO. 5D ÷ NO. 1) .....*
  - E. ANY OTHER POOR SHOTS .....  
*PERCENTAGE OTHER (NO. 5E ÷ NO. 1) .....*
  - TOTAL POOR SHOTS.....  
*PERCENTAGE TOTAL POOR SHOTS*  
*(TOTAL POOR ÷ NO. 1) .....*

THINK POSITIVE ON THESE STATS, CONCENTRATE ON  
YOUR GAME AND INCREASE THE PERCENTAGE OF  
YOUR GOOD SHOTS.

PRACTICE NOTES:

FIG. 4

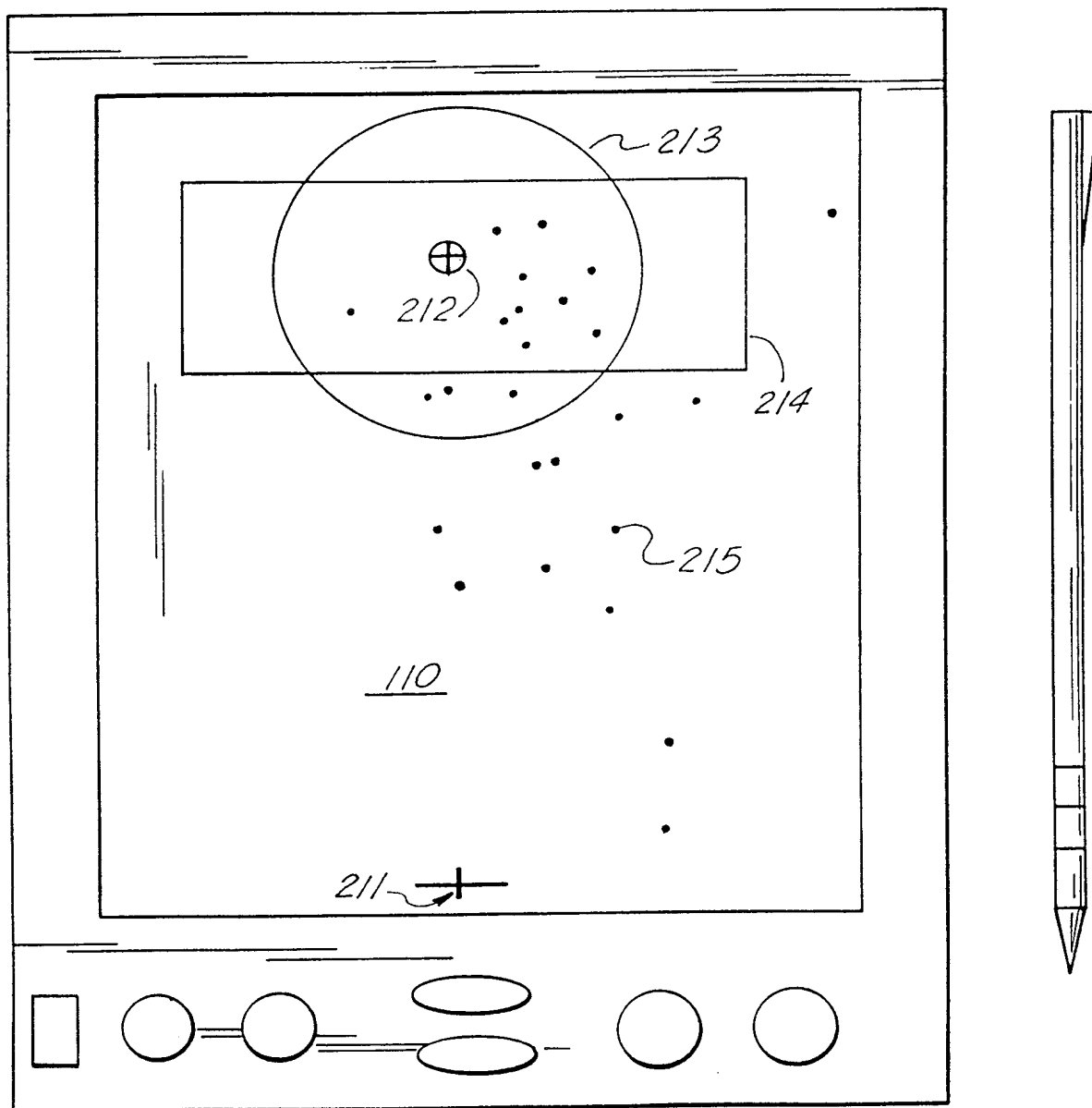


FIG. 5

<p>STATISTICAL DATA PRACTICE SESSION 12 USER RN</p> <p>1. Total Recorded Hits _____ 2. Total Hits in Main Target Area _____ 3. Total hits in Secondary Target Area _____ 4. Number of Poor Shots. a. Out of Bounds Left _____ percentage of total _____ b. Out of Bounds Right _____ percentage of total _____ c. Fat Shots _____ percentage of total _____ d. Thin Shots _____ percentage of total _____ e. Unclassified Poor Shots _____ percentage of total _____</p> <p>TOTAL POOR SHOTS _____ percentage of total _____</p> <p>INSTRUCTIONAL COMMENTARY _____ _____</p>
--

□ ○ ○ ○ ○ ○



Figure 6

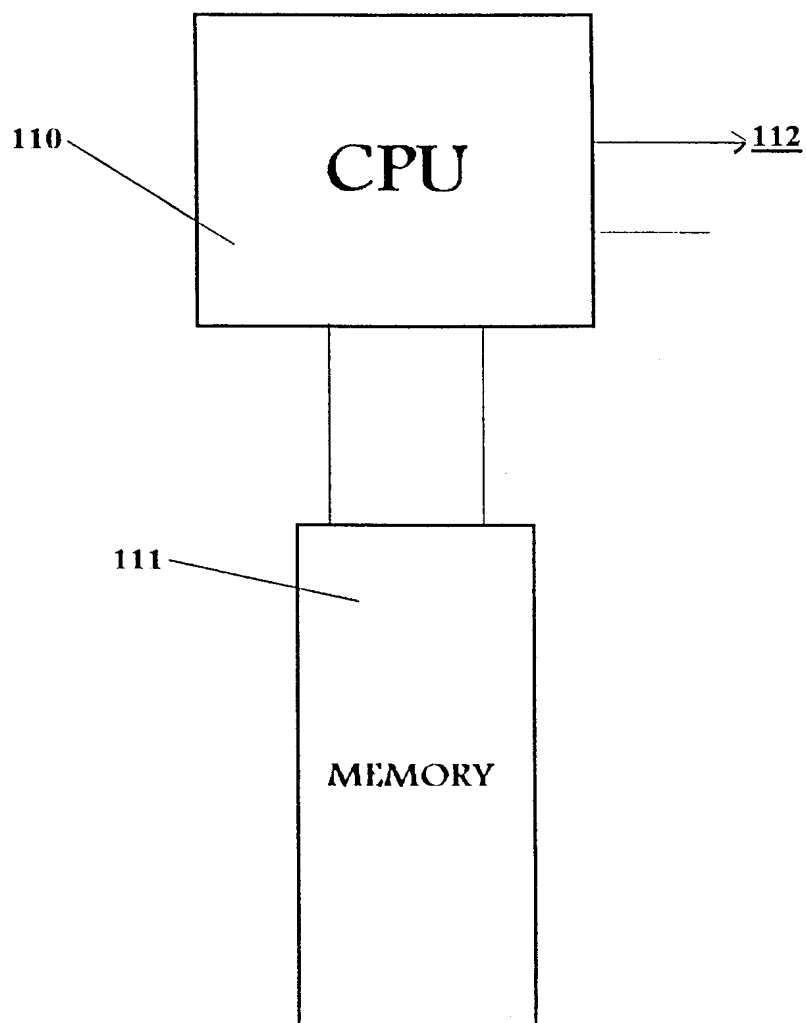


Figure 7

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US97/10097

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) :A63B 67/02

US CL :434/252; 473/407

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 473/150, 168, 169, DIG. 26

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
NONEElectronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
NONE**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,655,451 A (TOWNSLEY) 07 April 1987, entire document.	1-21
A	US 4,666,157 A (BODINE et al.) 19 May 1987, entire document.	1-21
A	US 4,783,071 A (TATTERSHALL) 08 November 1988, entire document.	1-21

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

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